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Methicillin-Resistant *Staphylococcus aureus* Carriage in Patients Hospitalized for Open Fractures: Prevalence and Associated Factors at Mohammed VI University Hospital, Marrakech

Boumediane El Mehdi*, Benhima Mohamed Amine, Soleh Abdewahed, Fath El Khir Yassine and Imad Abkari

Service de Traumatologie-Orthopédie, Hôpital Arrazi, CHU Mohammed VI, Marrakech, Morocco

***Corresponding Author:** Boumediane El Mehdi, Service de Traumatologie-Orthopédie, Hôpital Arrazi, CHU Mohammed VI, Marrakech, Morocco.

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Abstract

Introduction and Aim: Methicillin-resistant *Staphylococcus aureus* (MRSA) carriage represents a major concern in hospital settings, particularly in orthopedic trauma, where it may contribute to surgical site infections. In patients hospitalized for open fractures, this risk is increased due to skin barrier disruption, initial contamination, and the frequent need for surgical management. The aim of this study was to assess the prevalence of MRSA carriage among patients admitted for open fractures at Mohammed VI University Hospital in Marrakech.

Materials and Methods: This was a prospective cross-sectional study conducted over six months, from February to July 2025, including patients admitted for open fractures. Nasal and skin swabs were collected from each patient. Samples were cultured on Chapman agar. Bacterial identification was performed using conventional methods, and methicillin resistance was assessed using a 30 µg cefoxitin disk. A complete antibiogram was performed for MRSA strains according to CASFM recommendations.

Results: A total of 103 patients were included. The mean age was 46.65 years, with a female-to-male ratio of 0.73. The prevalence of nasal carriage of *Staphylococcus aureus* was 20% (n = 21), with all strains being methicillin-sensitive. The prevalence of cutaneous MRSA carriage was 3% (n = 3). Seventy-one percent of patients had grade II leg fractures according to the Cauchoix and Duparc classification. All MRSA carriers had a history of hospitalization and antibiotic therapy, and 67% had long-standing diabetes (>10 years).

Conclusion: The prevalence of cutaneous MRSA carriage in this series was low. However, the presence of identifiable risk factors supports the need for targeted surveillance, reinforcement of hygiene measures, and consideration of screening and decolonization strategies in high-risk patients prior to orthopedic surgery [2,6,7].

Keywords: *MRSA; Open Fracture; Nasal Carriage; Skin Carriage; Orthopedic Trauma; Surgical Site Infection*

Introduction

Infections caused by methicillin-resistant *Staphylococcus aureus* represent a major issue in hospital practice due to their widespread occurrence, impact on postoperative morbidity, and therapeutic challenges related to antibiotic resistance. In orthopedic surgery, nasal carriage of *S. aureus* is recognized as a significant risk factor for surgical site infection, particularly when the colonizing strain corresponds to the infecting strain [1,3].

Open fractures represent a particularly high-risk context for infection. They involve skin disruption, initial wound contamination, and often require urgent surgical intervention. Several risk factors for infection following open fractures have been described, including diabetes, lower limb fractures, and vulnerable patient conditions [8].

In this context, identifying MRSA carriage may help better target preoperative preventive measures.

Aim of the Study

The aim of this study was to evaluate the prevalence of MRSA carriage among patients hospitalized for open fractures in the orthopedic trauma department of Mohammed VI University Hospital in Marrakech and to describe the characteristics of carriers.

Materials and Methods

Study design and period

This was a prospective cross-sectional study conducted over a six-month period, from February to July 2025.

Setting

The study was carried out in the orthopedic trauma department of Mohammed VI University Hospital in Marrakech.

Study population

Patients admitted for open fractures during the study period were included.

Microbiological methods

Nasal and skin swabs were collected from all included patients. Samples were cultured on selective Chapman agar. Identification of isolates was performed using conventional methods (catalase test, agglutination test, and DNase test). Methicillin resistance was assessed using a 30 µg cefoxitin disk. A complete antibiogram was performed for MRSA strains according to CASFM recommendations.

Data collection

Collected variables included age, sex, type of fracture, site of bacterial carriage, and risk factors among carriers, particularly prior hospitalization, antibiotic use, and diabetes.

Statistical analysis

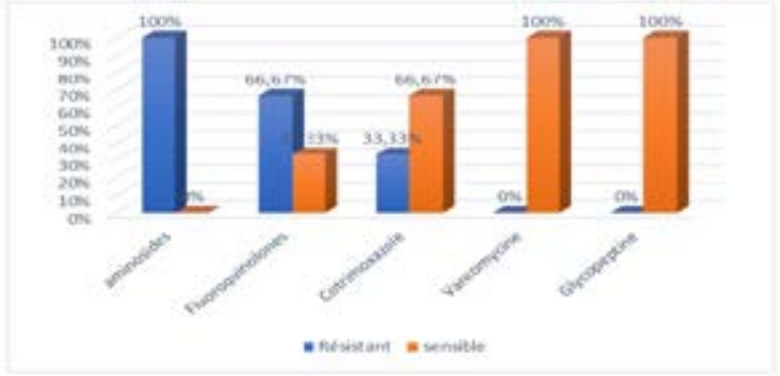
The available data primarily allowed descriptive analysis. No comparative statistical tests or multivariate models were detailed in the source document.

Results

A total of 103 patients were included. The mean age was 46.65 years, and the female-to-male ratio was 0.73. The prevalence of nasal carriage of *Staphylococcus aureus* was 20% (n = 21), with all isolates being methicillin-sensitive. The prevalence of cutaneous MRSA carriage was 3% (n = 3).

Additionally, 71% of patients had grade II leg fractures according to the Cauchoix and Duparc classification. All MRSA carriers had a history of hospitalization and antibiotic therapy, and 67% had long-standing diabetes of more than 10 years.

An analysis of antibiotic susceptibility profiles of MRSA strains was also performed.



Figure

Discussion

In our series, the prevalence of cutaneous MRSA carriage was 3%, whereas nasal carriage of *S. aureus* reached 20%, with no methicillin resistance among nasal isolates. These findings suggest that *S. aureus* colonization remains frequent in patients with open fractures, although the specific proportion of MRSA is low.

Nasal carriage of *S. aureus* is a well-established major risk factor for surgical site infection in orthopedic surgery [1,3]. Kalmeijer., *et al*. demonstrated that nasal carriage is the main independent risk factor for surgical site infections [1]. Similarly, Bode., *et al*. showed that rapid screening followed by targeted decolonization significantly reduces nosocomial infections due to *S. aureus* [2].

These findings have been confirmed by subsequent studies and meta-analyses, highlighting the benefit of preoperative screening and decolonization strategies in reducing surgical site infections [5,6].

Current recommendations support a selective rather than universal screening approach. WHO guidelines emphasize multimodal strategies, including hygiene measures, appropriate antibiotic prophylaxis, and consideration of *S. aureus* carriage [7]. Recent ESCMID/EUCIC guidelines recommend screening for *S. aureus* before high-risk procedures, including orthopedic surgery, with targeted decolonization using intranasal mupirocin and chlorhexidine [9].

In our study, all MRSA carriers had a history of hospitalization and antibiotic use, and most had long-standing diabetes. These findings are consistent with known risk factors for multidrug-resistant bacteria carriage and postoperative infections. In open fractures, diabetes, male sex, and lower limb involvement have been identified as risk factors for infection [8].

The high proportion of grade II leg fractures (71%) is also noteworthy, as lower limb open fractures are particularly prone to infection due to soft tissue vulnerability and contamination.

Thus, although MRSA prevalence was low, our results support targeted screening in high-risk patients rather than universal screening, in line with current literature and international guidelines [5,9].

Limitation of the Study

The main limitations of this study include the small number of MRSA carriers, the lack of comparative statistical analysis, and the absence of postoperative follow-up to directly assess infection outcomes.

Conclusion

Cutaneous MRSA carriage among patients hospitalized for open fractures in our series was low, whereas nasal carriage of *Staphylococcus aureus* was more frequent. MRSA carriers exhibited identifiable risk factors, including prior hospitalization, antibiotic exposure, and long-standing diabetes.

These findings support a targeted prevention strategy combining strict hygiene measures, microbiological surveillance, and consideration of preoperative screening and decolonization in high-risk patients [2,6,9,10].

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